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Lesperance et al.

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(54) **PORTABLE CONTROL SYSTEM FOR ROTARY-WING AIRCRAFT LOAD MANAGEMENT**

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B64D 1/22 (2006.01)

(52) **U.S. Cl.**
CPC ***B64D 1/22*** (2013.01); ***G05D 1/0016*** (2013.01); *B64C 2201/128* (2013.01); *B64C 2201/146* (2013.01)

(58) **Field of Classification Search**
CPC B64D 1/22; B64C 2201/146; B64C 2201/128
USPC 244/137.4, 190; 701/2
See application file for complete search history.

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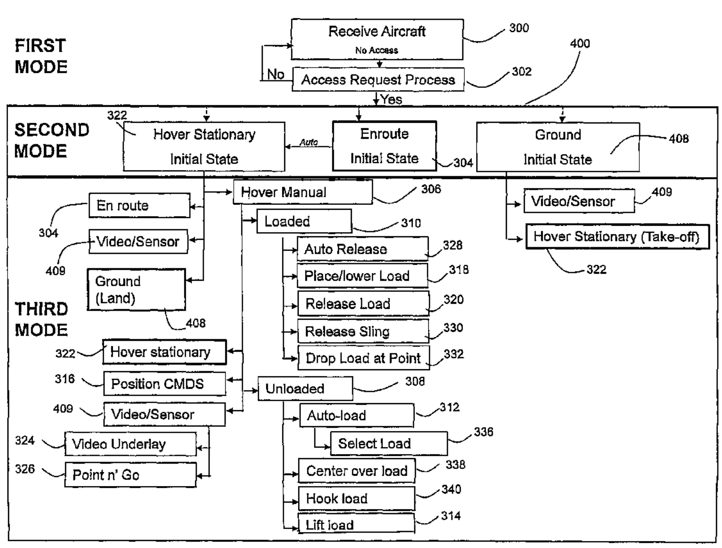
(57) **ABSTRACT**

A control system for portable control of a rotary-wing aircraft includes a portable, hand-held, control device executing a control application, the control device operating in a loaded mode when a load is attached to the rotary-wing aircraft and an unloaded mode when no load is attached to the rotary-wing aircraft, the control device presenting command icons in response to being in loaded mode and unloaded mode; a vehicle management system in the rotary-wing aircraft; a sensor package on the rotary-wing aircraft; and a communication system providing communications between the control device and the rotary-wing aircraft, vehicle management system and sensor package; wherein the control device communicates commands to the vehicle management system to implement loading and unloading of the rotary-wing aircraft.

19 Claims, 15 Drawing Sheets



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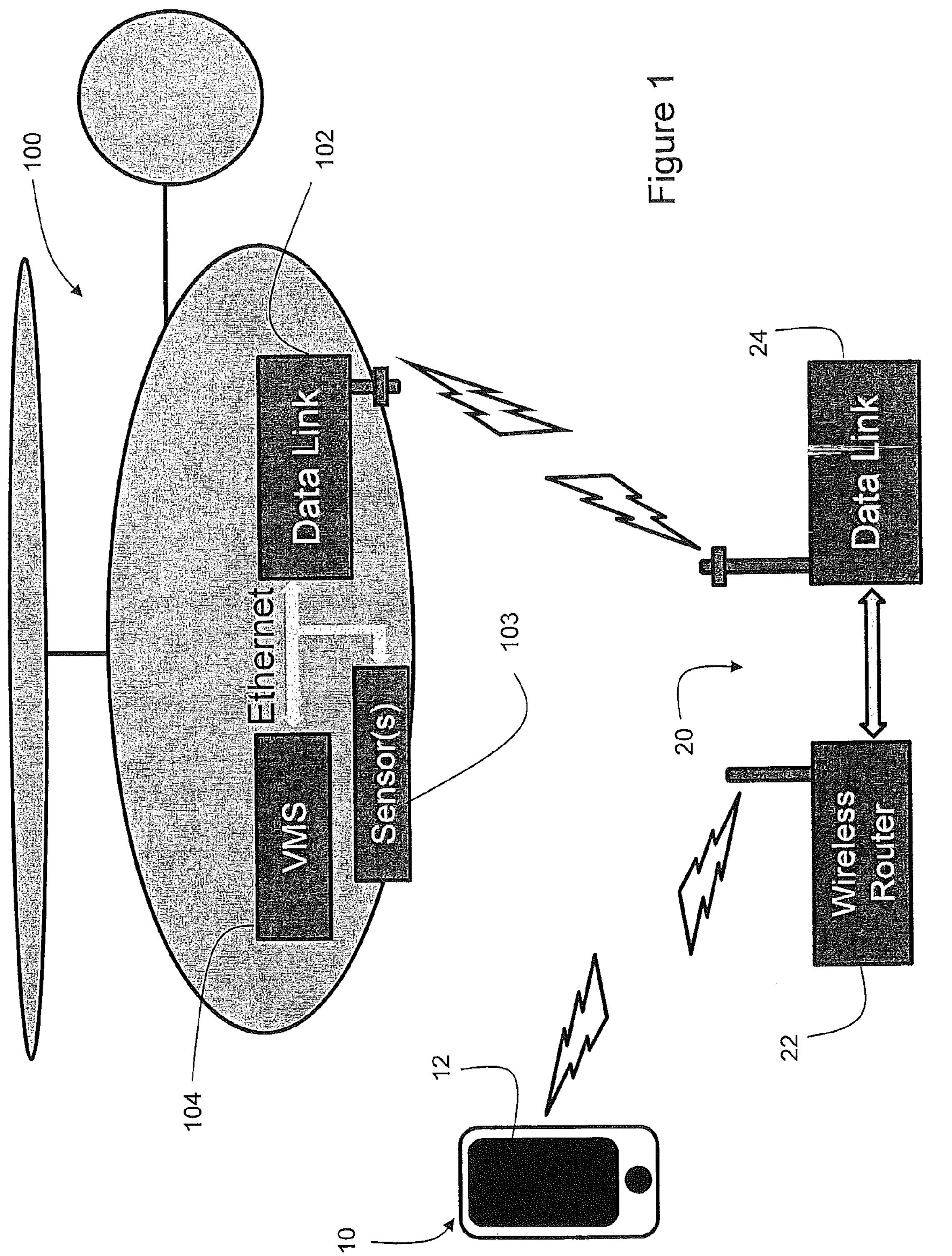
100
102
Data Link
Ethernet
VMS
Sensor(s)
103
104
24
Data Link
20
Wireless Router
22
12
10

Figure 1

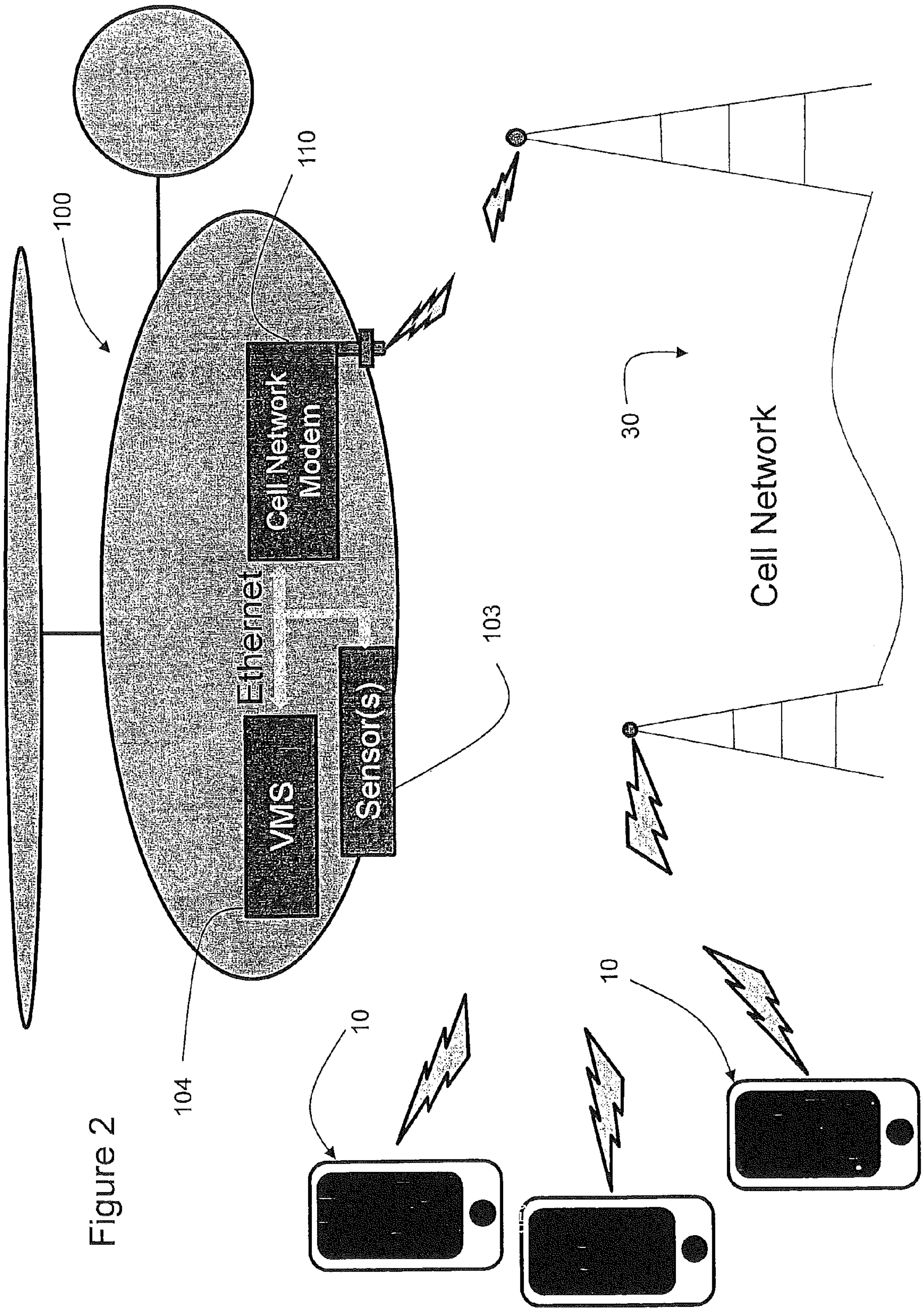
100
110
Cell Network Modem
Ethernet
VMS
Sensor(s)
103
104
30
Cell Network
10
10
10

Figure 2

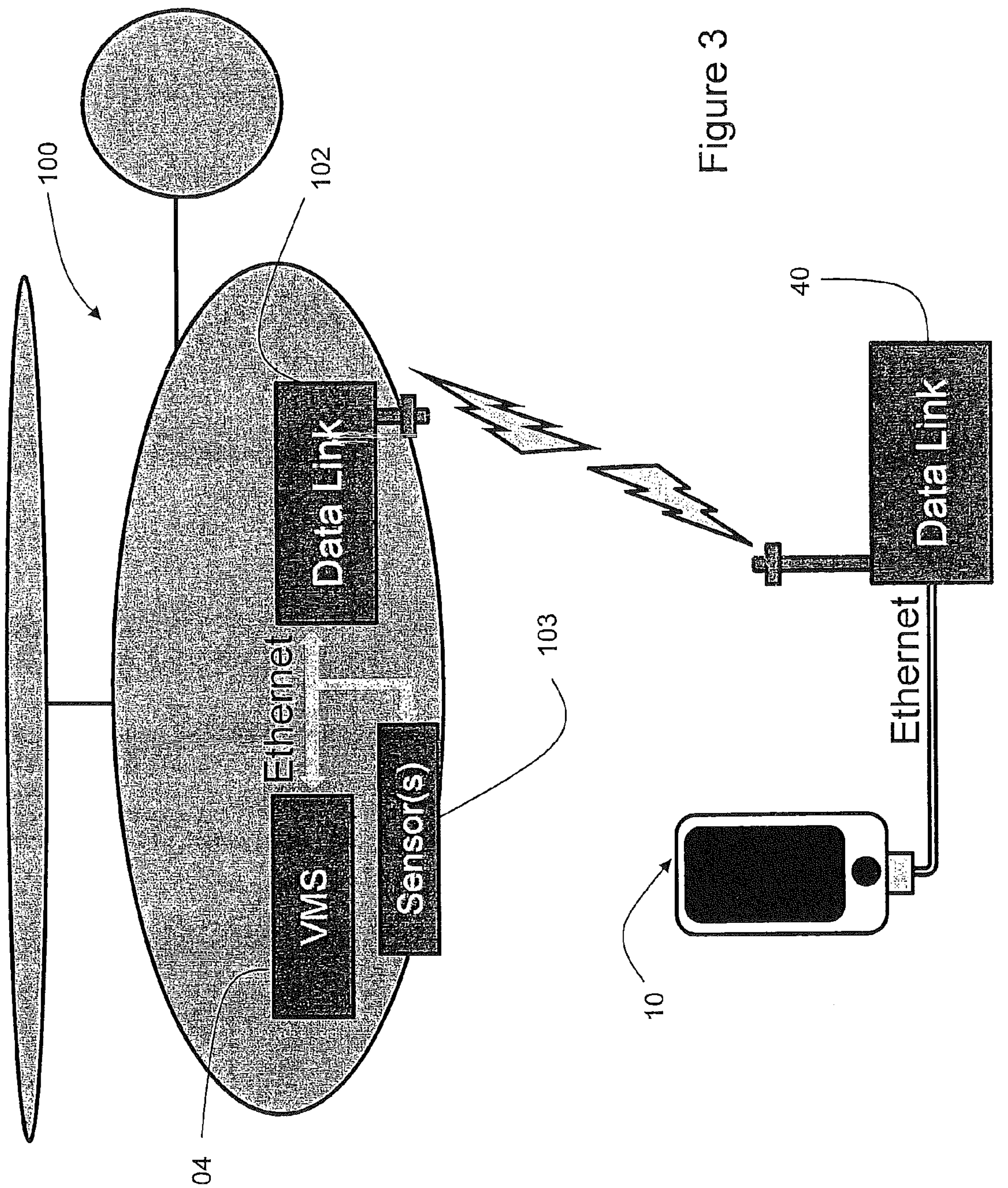
100
102
Data Link
Ethernet
VMS
Sensor(s)
103
104
40
Data Link
Ethernet
10

Figure 3

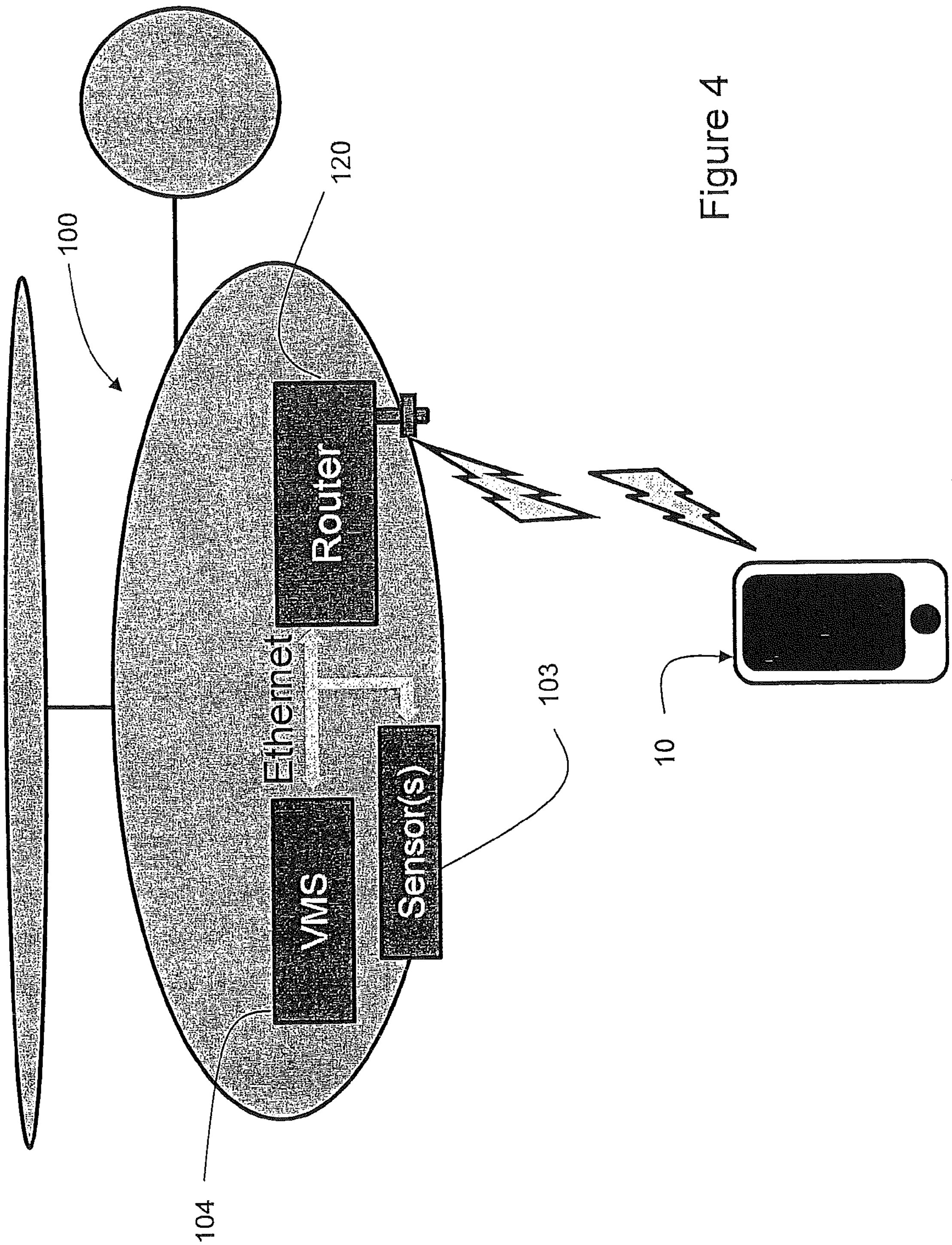

Figure 4

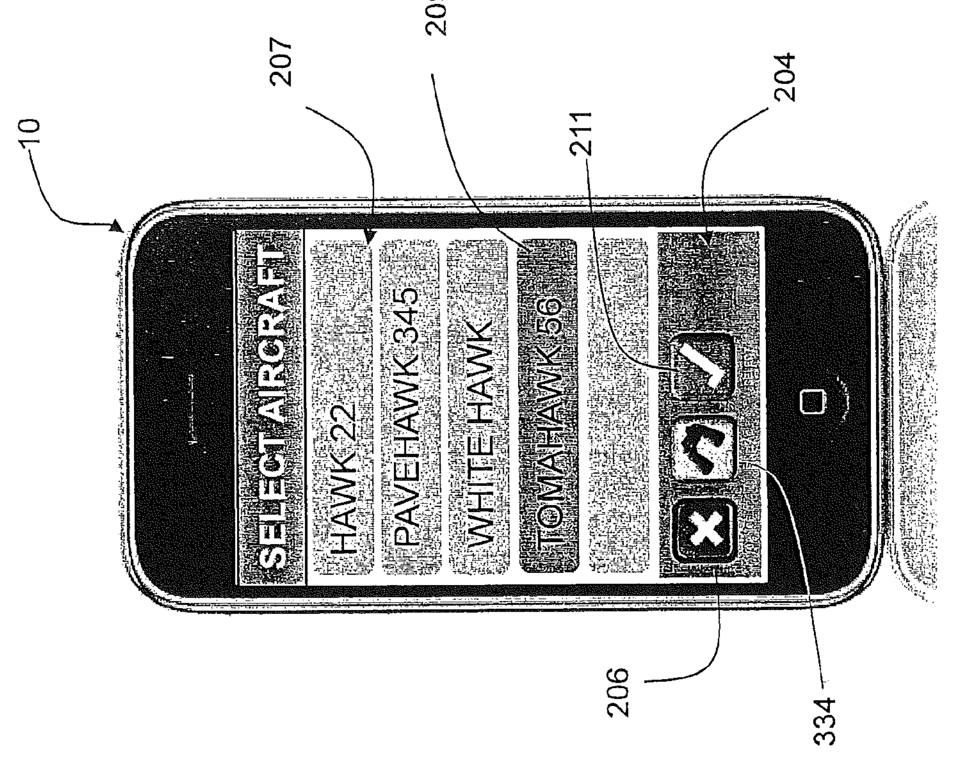
10
207
209
211
204
SELECT AIRCRAFT
HAWK 22
PAVEHAWK 345
WHITE HAWK
TOMAHAWK 56
206
334

Figure 5

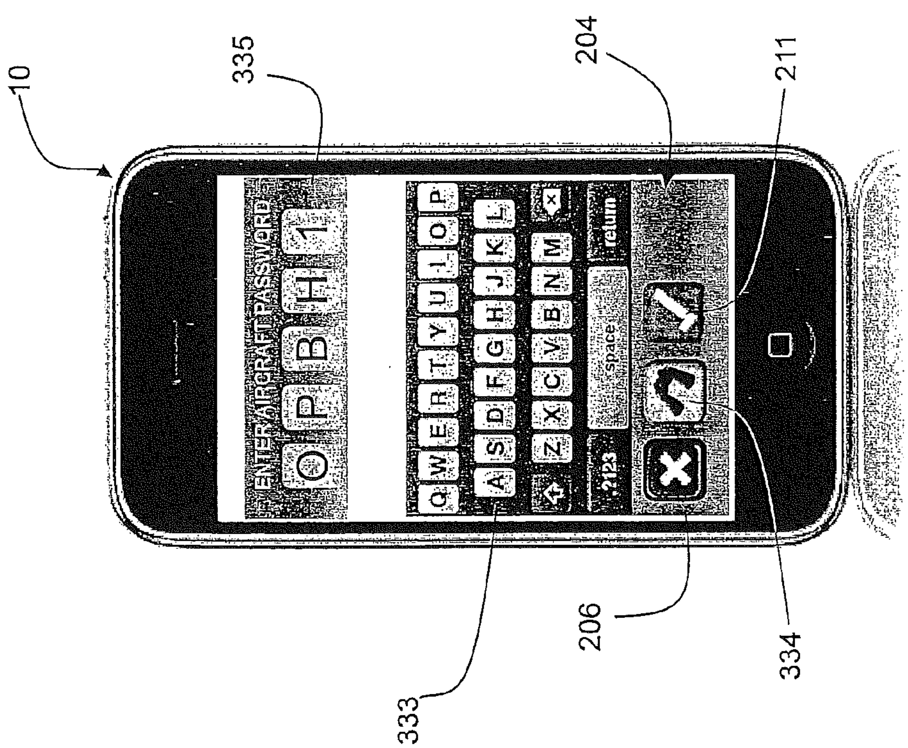

Figure 6

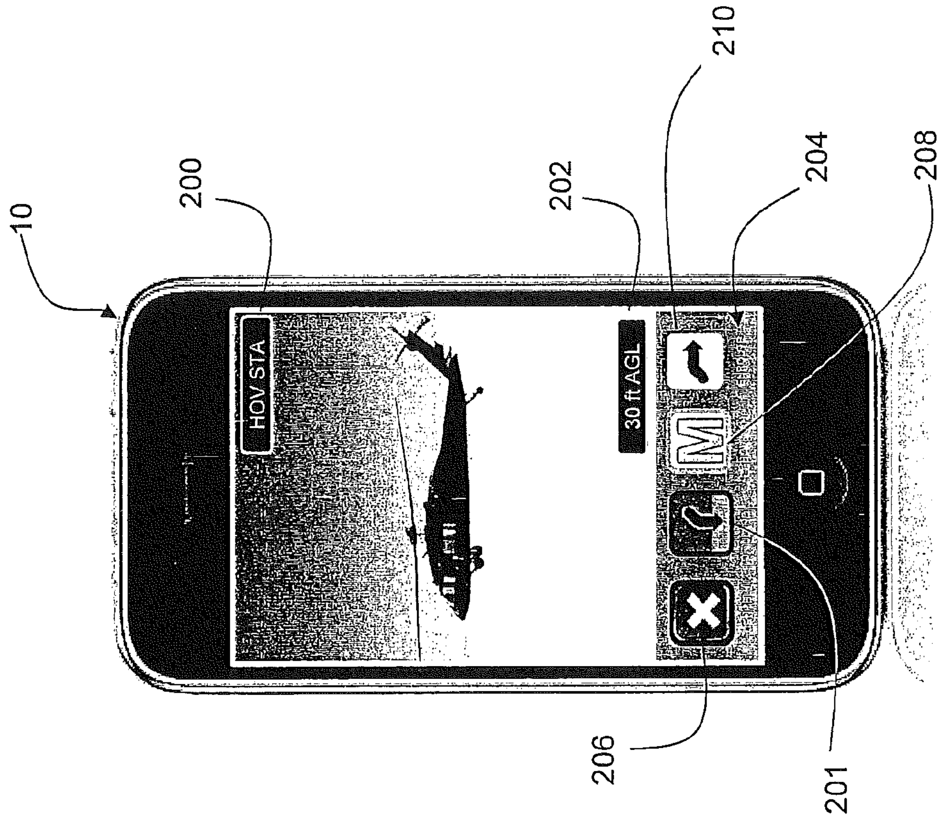

Figure 7

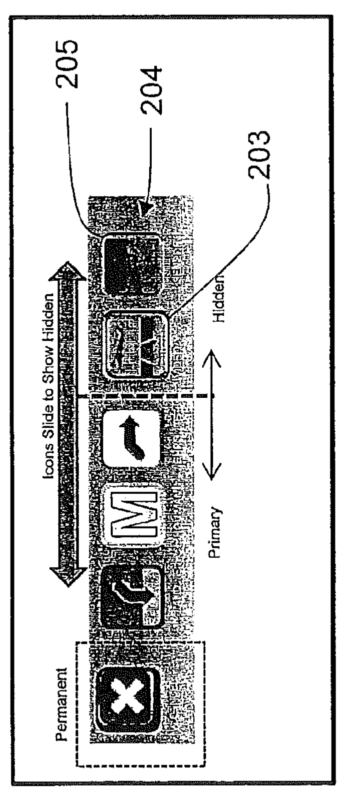

Figure 7A

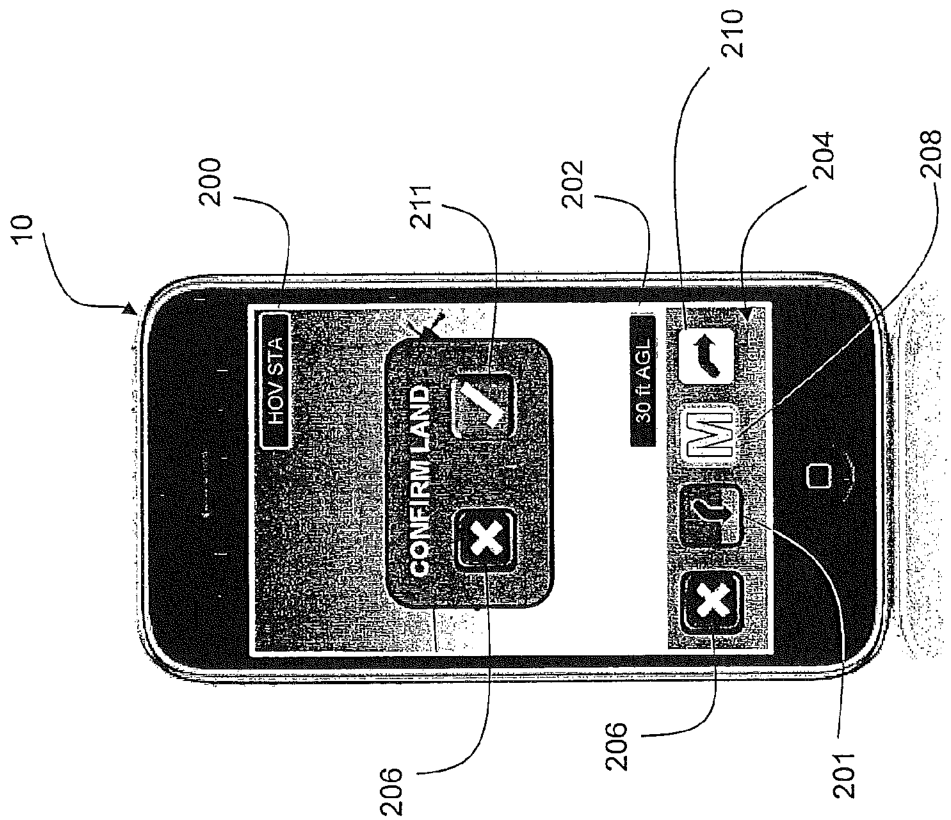
10
200
211
202
210
204
208
HOV STA
CONFIRM LAND
30 ft AGL
M
206
206
201

Figure 8

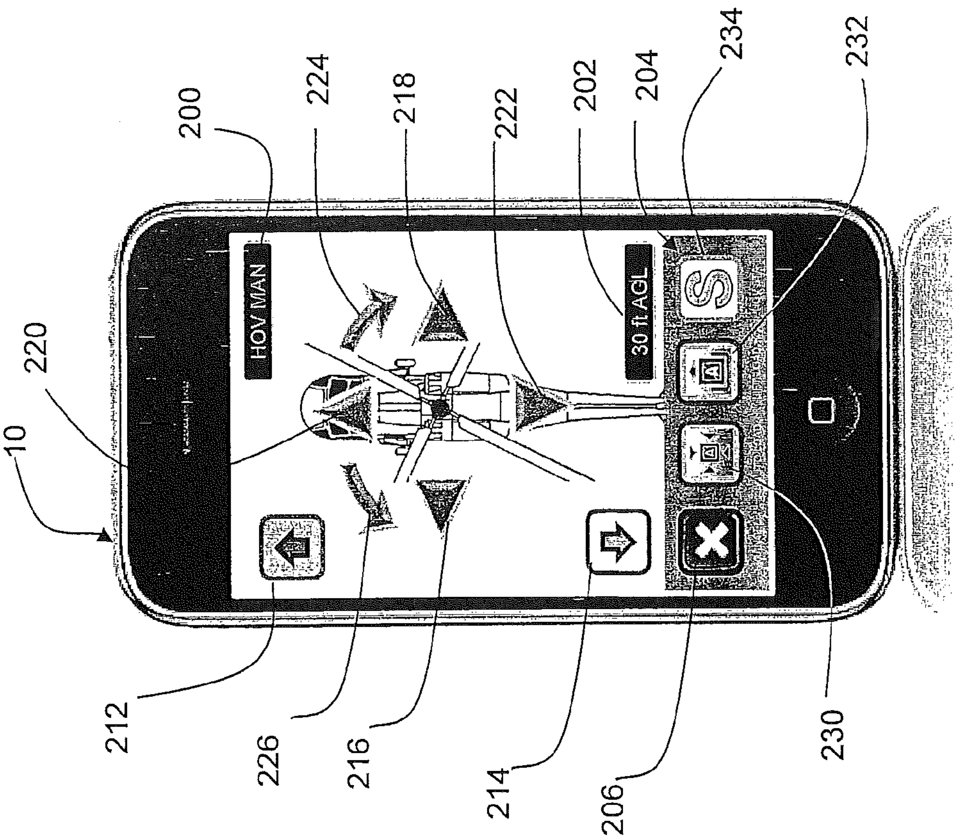

Figure 9

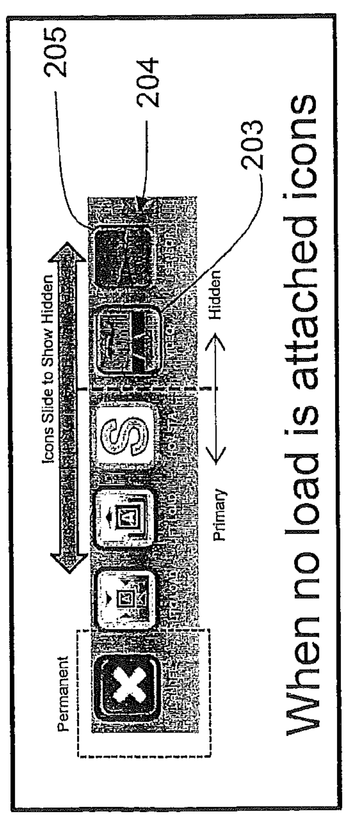

Figure 9A

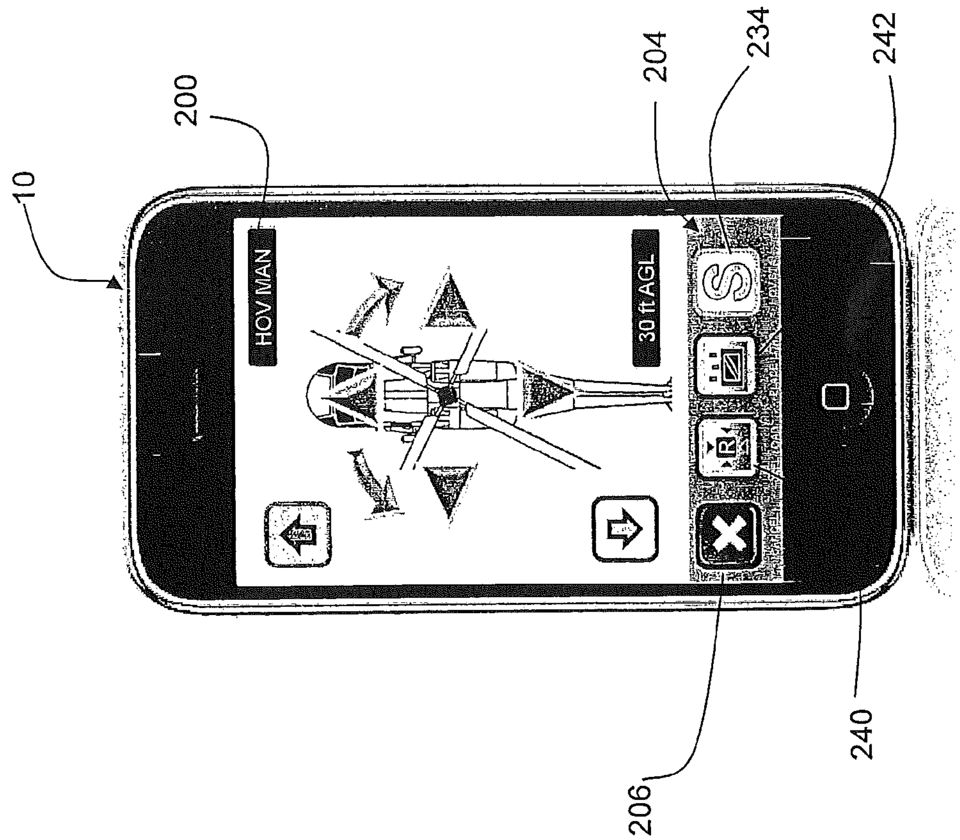

Figure 10

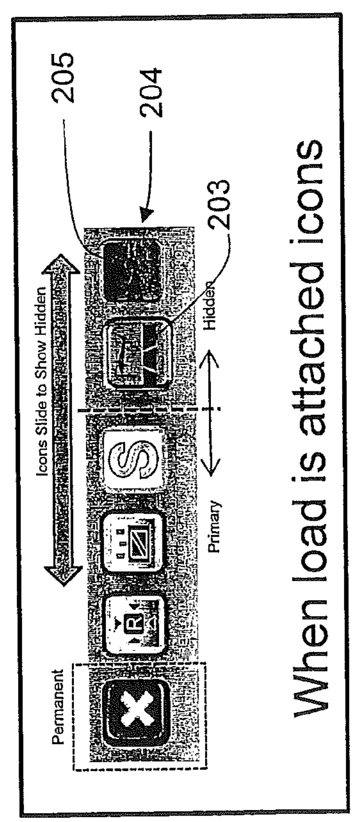

Figure 10A

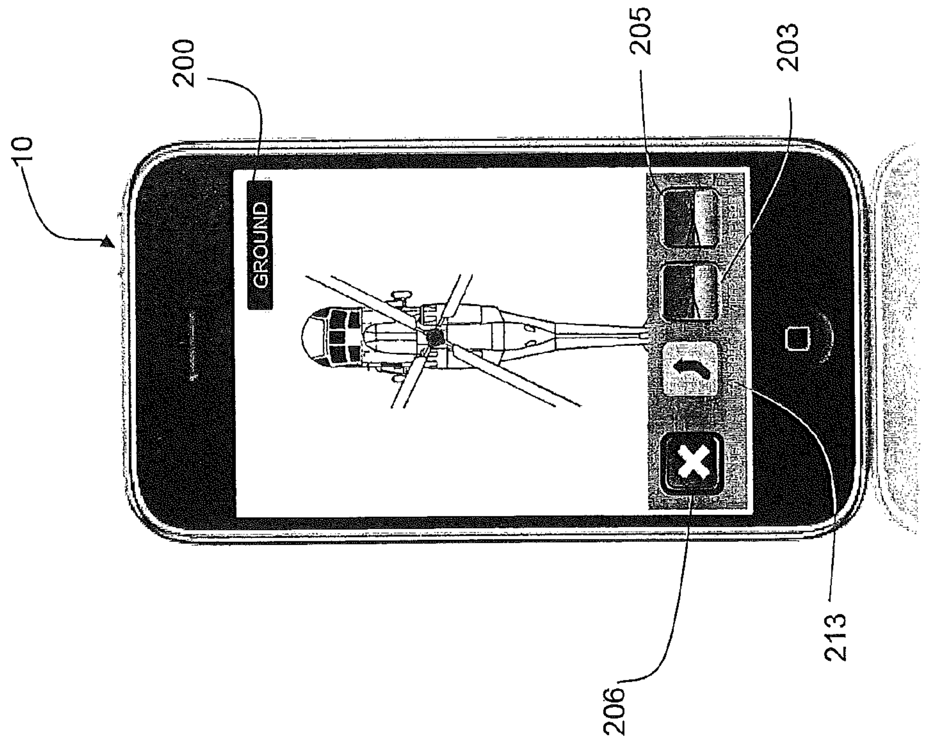

Figure 11

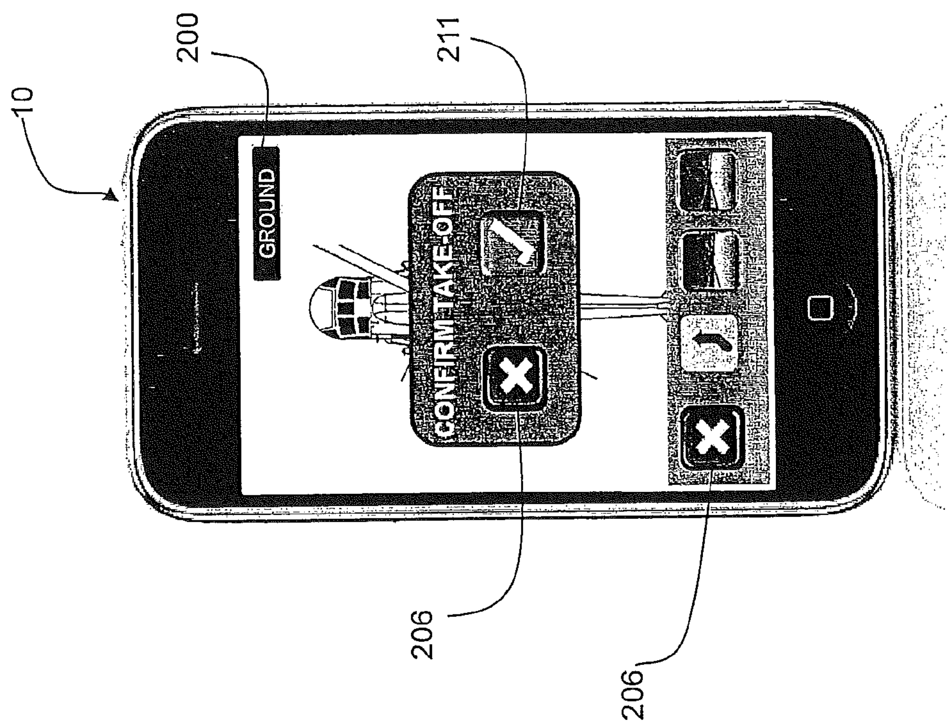

Figure 12

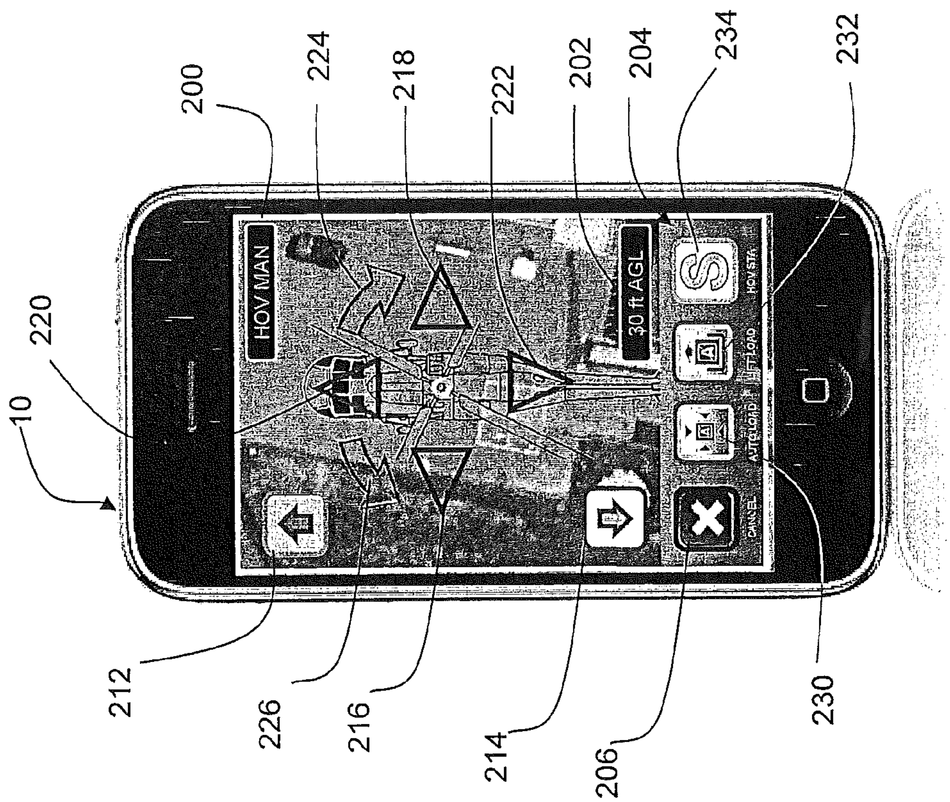

Figure 13

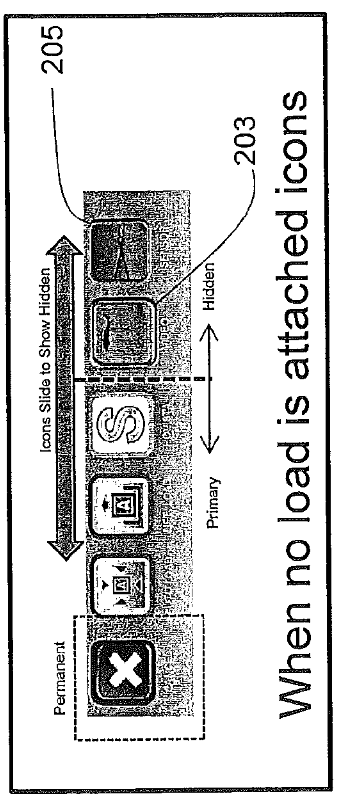

Figure 13A

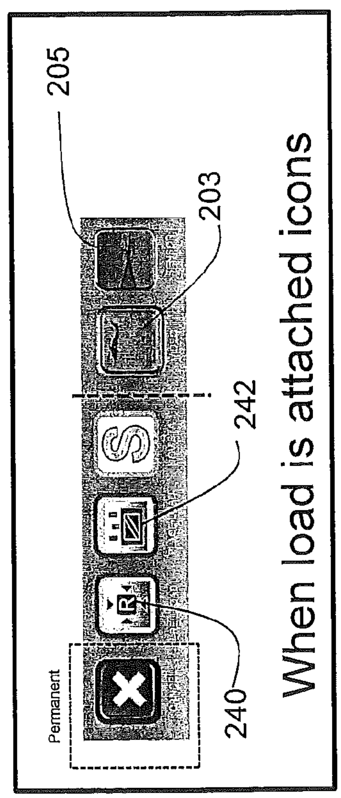

Figure 13B

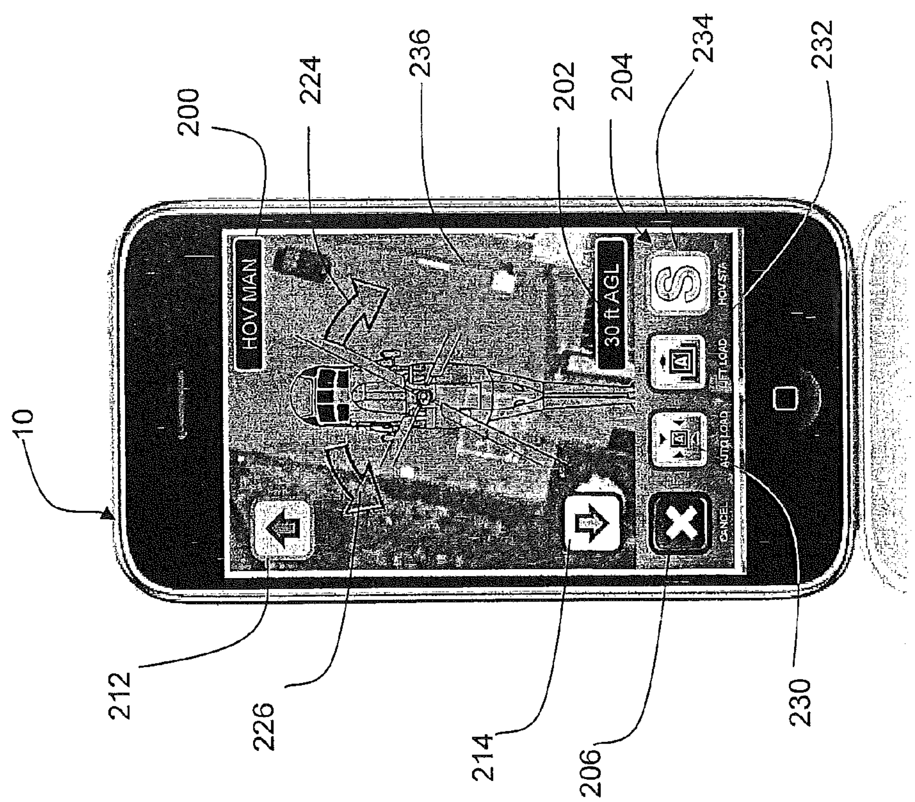

Figure 14

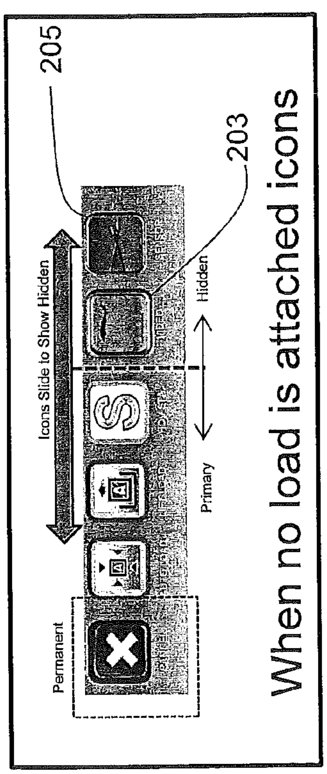

Figure 14A

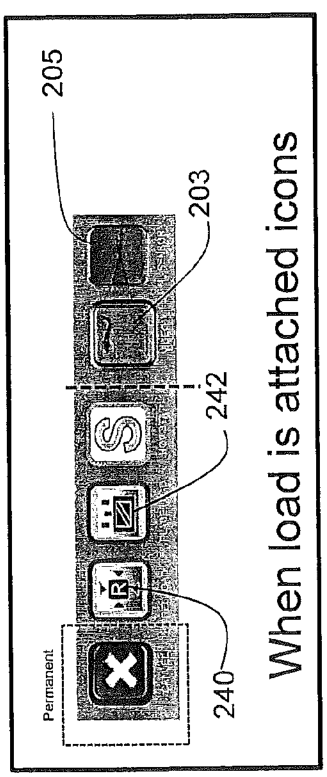

Figure 14B

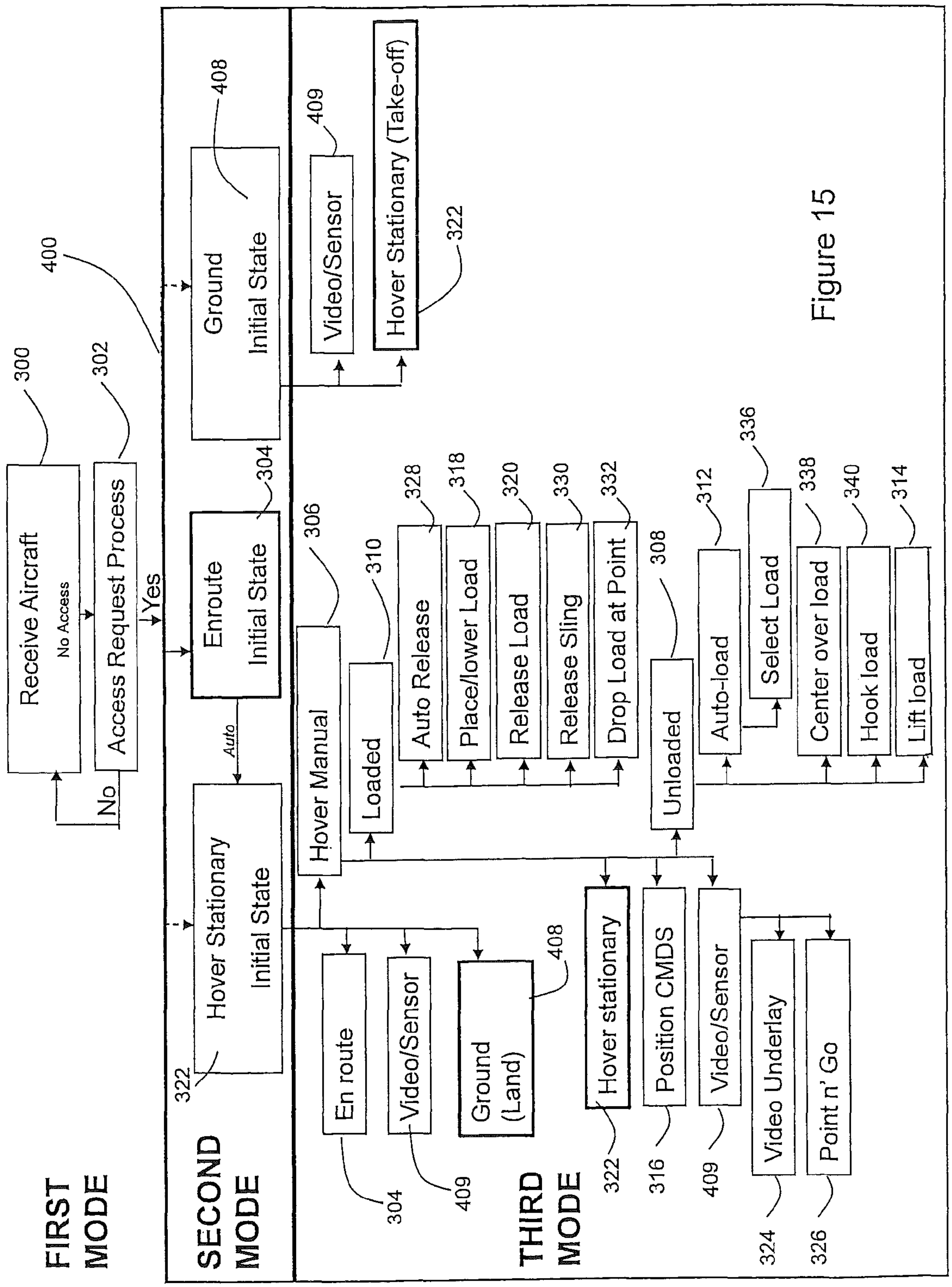
FIRST MODE
Receive Aircraft
No Access
Access Request Process
No
Yes
300
302
400
SECOND MODE
Hover Stationary Initial State
Enroute Initial State
Ground Initial State
Auto
322
304
408
THIRD MODE
En route
Video/Sensor
Ground (Land)
Hover Manual
Loaded
Auto Release
Place/lower Load
Release Load
Release Sling
Drop Load at Point
Unloaded
Auto-load
Select Load
Center over load
Hook load
Lift load
Hover stationary
Position CMDS
Video Underlay
Point n' Go
Hover Stationary (Take-off)
304
409
408
306
310
328
318
320
330
332
308
312
336
338
340
314
322
316
409
324
326
409
322

Figure 15

PORTABLE CONTROL SYSTEM FOR ROTARY-WING AIRCRAFT LOAD MANAGEMENT

BACKGROUND

The subject matter disclosed herein relates generally to remote control of rotary-wing aircraft, and more particularly to a portable control system for rotary-wing aircraft load management.

Often it is desirable to provide remote, portable control of an aircraft. Existing ground control stations for unmanned aircraft employ bulky ground control stations including humvees and man wearable equipment. These systems, for a resupply operation, for example, require the pick-up zone and receiving zone operators to have dedicated systems. It would be beneficial to provide a ground control system using a more ubiquitous control interface to facilitate and simplify remote control of aircraft, and in particular rotary-wing aircraft load management.

SUMMARY

One embodiment includes a control system for portable control of a rotary-wing aircraft, the control system including a portable, hand-held, control device executing a control application, the control device operating in a loaded mode when a load is attached to the rotary-wing aircraft and an unloaded mode when no load is attached to the rotary-wing aircraft, the control device presenting command icons in response to being in loaded mode and unloaded mode; a vehicle management system in the rotary-wing aircraft; a sensor package on the rotary-wing aircraft; and a communication system providing communications between the control device and the rotary-wing aircraft, vehicle management system and sensor package; wherein the control device communicates commands to the vehicle management system to implement loading and unloading of the rotary-wing aircraft.

Other aspects, features, and techniques of the invention will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings wherein like elements are numbered alike in the several Figures, in which:

FIG. **1** depicts a control system architecture in an exemplary embodiment;

FIG. **2** depicts a control system architecture in another exemplary embodiment;

FIG. **3** depicts a control system architecture in another exemplary embodiment;

FIG. **4** depicts a control system architecture in another exemplary embodiment;

FIG. **5** depicts a human-machine interface on a control device in an exemplary embodiment in a first mode;

FIG. **6** depicts a human-machine interface on a control device in an exemplary embodiment in a first mode;

FIGS. **7** and **7**A depict a human-machine interface on a control device in an exemplary embodiment in a hover stationary (HOV STA) mode;

FIG. **8** depicts a human-machine interface on a control device in an exemplary embodiment in a hover stationary mode;

FIGS. **9** and **9**A depict a human-machine interface on a control device in an exemplary embodiment in a hover manual (HOV MAN) mode, with no load attached;

FIGS. **10** and **10**A depict a human-machine interface on a control device in an exemplary embodiment in the hover manual (HOV MAN) mode with a load attached;

FIG. **11** depicts a human-machine interface on a control device in an exemplary embodiment in a ground mode;

FIG. **12** depicts a human-machine interface on a control device in an exemplary embodiment in a ground mode;

FIGS. **13**, **13**A and **13**B depict a human-machine interface on a control device in an exemplary embodiment in a hover manual mode;

FIGS. **14**, **14**A and **14**B depict human-machine interface on a control device in an exemplary embodiment in a hover manual mode; and

FIG. **15** is a diagram of operational states of the control device in exemplary embodiments.

DETAILED DESCRIPTION

Embodiments relate to systems and methods for providing control of rotary-wing aircraft, and in particular, to control of loading and unloading of loads to and from the rotary-wing aircraft. FIG. **1** depicts a control system architecture in an exemplary embodiment. The control system includes a control device **10** for controlling a rotary-wing aircraft (e.g., helicopter) **100**. Control device **10** may be a portable, hand-held, microprocessor-based device having a display screen **12** that provides for a human-machine interface. The processor of control device **10** executes a control application to interface with rotary-wing aircraft **100**. Control device **10** also includes wireless communications functionality as described in detail herein. Exemplary devices that may serve as control device **10** include tablet computers, personal digital assistants, mobile phones, media players, etc.

In the embodiment shown in FIG. **1**, control device **10** communicates with rotary-wing aircraft **100** via a communication system **20**. Communication system **20** includes a wireless router **22** and wireless data link **24**. Wireless router **22** communicates back and forth with control device **10** using known wireless communications protocols. Communications may use packet-based, single channel communications techniques, such as 802.11 standards, also referred to as Wi-Fi. Wireless router **22** is in bidirectional communication with data link **24** via a network connection (e.g., Ethernet). Wireless data link **24** uploads and downloads data to and from rotary-wing aircraft **100** using known uplink/downlink technologies, such as C/L/S/K/Ku-band wireless data links.

The rotary-wing aircraft **100** includes a data link **102** in bidirectional communication with data link **24**. Data link **102** is coupled to a vehicle management system (VMS) **104** via a network connection (e.g., Ethernet) and a sensor package **103**. Sensor package **103** provides video or equivalent data to a main or parallel data link system. VMS **104** controls rotary-wing aircraft **100**. VMS **104** also collects flight status data from rotary-wing aircraft **100**. As described in further detail herein, flight status data from the VMS **104** is provided to control device **10**, and commands from control device **10** are provided to the VMS **104** to control the rotary-wing aircraft **100**.

FIG. **2** depicts a control system architecture in another exemplary embodiment. In the embodiment of FIG. **2**, the control device communication system is implemented using a cellular network **30**. The rotary-wing aircraft **100** includes a cellular network modem **110** in communication with the VMS **104** via a network connection (e.g., Ethernet). In this embodiment, bidirectional communication between control device **10** and rotary-wing aircraft **100** occurs over cellular network **30**.

FIG. **3** depicts a control system architecture in another exemplary embodiment. In the embodiment of FIG. **3**, the control device communication system is implemented using a data link **40** coupled directly to the control device **10** via a wired network connection (e.g., Ethernet). The rotary-wing aircraft **100** includes a data link **102** in bidirectional communication with data link **40**. Data link **102** is coupled to a Vehicle Management System (VMS) **104** and to a sensor package **103** via a network connection (e.g., Ethernet).

FIG. **4** depicts a control system architecture in another exemplary embodiment. In the embodiment of FIG. **4**, the control device communication system is implemented using a wireless communication element of the control device **10** directly. The communication element may use packet-based, single channel communications techniques, such as 802.11 standards, also referred to as Wi-Fi. The rotary-wing aircraft **100** includes wireless router **120** using the same communications standard as the control device **10**. Wireless router **120** is in bidirectional communication with control device **10**. Wireless router **120** is coupled to a vehicle management system (VMS) **104** and to a sensor package **103** via a network connection (e.g., Ethernet).

FIG. **5** depicts a human-machine interface on a control device **10** in an exemplary embodiment in a receive aircraft mode of a first mode. The human-machine interface will include an available aircraft list **207** of those within range by selecting find aircraft icon **334**. The find aircraft icon **334** searches the area for local rotary-wing aircraft **100** and provides a selection of available aircraft to choose from (e.g., Bluetooth pairing). Upon selection of a rotary-wing aircraft **100** from the aircraft list **207**, the selection will be highlighted **209** and then either confirmed **211** or canceled **206** via the human-machine interface command icons **204**. Another method for aircraft acquisition is a push. In a push operation, an aircraft available notification appears when a rotary-winged aircraft **100** is within range or handoff from main operator of the aircraft is pushed to the control device **10**. The operator of the portable control device **10** would then confirm/accept the rotary-winged aircraft **100** to complete the push transaction.

FIG. **6** depicts a human-machine interface on a control device **10** in an exemplary embodiment in an access code mode of the first mode. In the first mode, the user of control device **10** is attempting to obtain access to aircraft control. Control device **10** enters an access code mode. The human-machine interface includes a keyboard **333** for entering characters of the access password. The human-machine interface will include a text bar **335** that displays the password as entered via the keyboard **333**. After a rotary-wing aircraft **100** is chosen, and the password for the specific aircraft is entered, selection of the return icon or confirm **211** will send the password from the control device **10** to the rotary-winged aircraft **100** for verification. Referring to FIG. **6**, selection of cancel icon **206** cancels access of the rotary-wing aircraft **100** by control device **10**. Acceptance by the rotary-winged aircraft **100** initiates second mode screen or if access denied, reverts back to find aircraft screen FIG. **6** and provides incorrect password notification. As shown in FIG. **6**, the command icons **204** also include the cancel icon **206** as well as the find aircraft icon **334**.

FIGS. **7** and **7**A depicts a human-machine interface on a control device **10** in an exemplary embodiment in a hover stationary mode. The mode depicted in FIG. **7** is referred to as hover-stationary, meaning the rotary-wing aircraft **100** is hovering at a set location. The human-machine interface includes a status icon **200** indicating the current mode of control device **10** and rotary-wing aircraft **100**. Status information **202** may be presented, and include flight status information such as altitude, speed, heading, etc. This flight status information is communicated to control device **10** from VMS **104**. Command icons **204** are also presented in the human-machine interface. Upon selection of one of the command icons **204**, control device **10** issues commands to the rotary-wing aircraft **100** to execute an operation. Command icons **204** in FIGS. **7** and **7**A include a cancel icon **206**, selection of which cancels current action of the rotary-wing aircraft **100** by control device **10**. Command icons **204** also include a hover manual icon **208**, selection of which places control device **10** and rotary-wing aircraft **100** into a mode for manually controlling the rotary-wing aircraft **100**. The command icons **204** also include an enroute icon **210**, selection of which causes the rotary-wing aircraft **100** to follow a preloaded flight plan, stored either in the VMS **104** or in the control device **10**. The commands icons **204** also include a land icon **201**, selection of which causes the rotary-wing aircraft **100** to autonomously execute a landing at its current lat/long. Command icons **204** may require a confirmation as described with reference to FIG. **8** to proceed with the given commands.

FIG. **7**A shows additional command icons **204** and a slide feature to display hidden command icons. In all states, cancel **206** is a fixed icon and available at all times. The other three available icon spaces can be scrolled. In addition to land **201**, hover manual **208**, and enroute **210**, hover stationary provides video **203** and sensor **205** icons for additional functionality. The video **203** and sensor **205** icons obtain real-time streaming video or sensor data from the rotary-wing aircraft **100** to the control device **10** for situational awareness. The video **203** and sensor **205** modes are available in a number of modes, such as hover manual and ground, as described further herein.

Upon selection of land **201**, the control device **10** will ask for confirmation as shown in FIG. **8**. The human machine interface will provide the option to confirm **211** or cancel **206** the last command. A confirm **211** will send the command to the rotary wing aircraft **100** for verification prior to execution.

FIGS. **9** and **9**A depict a human-machine interface on a control device **10** in an exemplary embodiment in the hover manual mode, entered upon selection of the hover manual icon **208** in FIG. **7**. The command icons **204** are updated to reflect currently available operations. The hover manual mode is designated by status icon **200**. A number of flight control icons are presented. Altitude control icons include an up icon **212** and down icon **214** to control height of the rotary-wing aircraft **100**. Selection of the up icon **212** or down icon **214** may cause a change in altitude based on a number of feet per selection (e.g., 2 feet per click) or continuous transition at a predetermined rate for as long as it is held (with limits defined by the VMS **104**). Position control icons include left icon **216**, right icon **218**, forward icon **220** and back icon **222**. Selection of the position control icons causes a change in position based on a number of feet per selection (e.g., 2 foot per click) or continuous transition at a predetermined rate for as long as it is held (maintain travel as icon is held). Heading control icons include rotational icons including clockwise rotation icon **224** and counter-clockwise rotation icon **226**. Selection of the rotational icons causes a change in heading, such as a number of degrees per selection or continuous yaw change at a predetermined rate.

Command icons **204** are updated once the control device **10** enters hover manual mode. As shown in FIGS. **9** and **9**A, the command icons include cancel icon **206**, auto load icon **230**, lift load icon **232**, hover stationary icon **234**, video/sensor icons **203**/**205**. Other icons may be added if needed. The command icons **204** are generated dependent upon whether the rotary-wing aircraft **100** currently has an auto load system attached, is secured to a load, or is not secured to a load. Cancel **206** is always available. The other command icons **204** slide to show the commands that cannot fit in the default menu (e.g., three commands) and are as a result hidden (such as the video/sensor icons **203**/**205**). The command icons in FIGS. **9** and **9**A are presented when no load is detected by the VMS **104**.

FIGS. **9** and **9**A depict a human-machine interface on a control device in an exemplary embodiment in a hover manual mode, in which a load is not attached to the rotary-wing aircraft **100**. In FIGS. **9** and **9**A, selection of cancel icon **206** cancels control of the rotary-wing aircraft **100** by control device **10** and transitions the aircraft to hover stationary mode. Selection of hover stationary icon **234** causes the control device **10** to enter hover stationary mode, with rotary-wing aircraft **100** hovering at a fixed position. The auto load icon **230** causes the VMS **104** to execute a flight control process that automatically positions the rotary-wing aircraft **100** over a load. The load may be manually or automatically secured to rotary-wing aircraft **100**. Once the load is secured, the lift load icon **232** can be selected to cause the rotary-wing aircraft **100** to lift the load to a predetermined height and hover. This entire process can be done autonomously via the selection of the Auto Load icon **230** (i.e. autonomous load systems attached). Video/Sensor icon **203**/**205** initiates a subcategory of the current third mode. Video/Sensor icons **203**/**205** will access data from a sensor/video devices **103** on the rotary-winged aircraft **100** and display it on the human-machine interface of the control device **10**.

FIGS. **10** and **10**A depict a human-machine interface on a control device in an exemplary embodiment, in hover manual mode in which a load is attached to the rotary-wing aircraft **100**. As noted above, the command icons **204** are updated to reflect currently available operations, based on flight information received from the VMS **104**. The command icons **204** include cancel icon **206**, release load icon **240**, place load icon **242** and hover stationary icon **234**. Selection of cancel icon **206** cancels control of the rotary-wing aircraft **100** by control device **10**. Selection of hover stationary icon **234** causes the rotary-wing aircraft **100** to enter hover stationary mode, with rotary-wing aircraft **100** hovering at a fixed position. Selection of the place load icon **242** causes the rotary-wing aircraft **100** to rest the load on the ground. Selection of the release load icon **240** causes the rotary-wing aircraft **100** to lower the load to the ground at the current aircraft position and release the load from the rotary-wing aircraft **100** (e.g., release a sling attachment, open hook, open auto load device) whereas place load **242** lowers the load to the ground at the current aircraft position, but does not release the load. Video/sensor icons **203**/**205** will access video or sensor data from sensor/video devices on the rotary-winged aircraft **100** and display it on the human-machine interface of the control device **10**.

FIG. **11** depicts a human machine interface on a control device **10** in an exemplary embodiment in a ground mode. The command icons **204** displayed across the bottom of the human machine interface include cancel **206**, take off **213**, video **203** and sensor **205**. Video **203** and sensor **205** commands activate an onboard video/sensor devices **103** on the rotary-wing aircraft **100** and transmit the data to the control device **10** where it is displayed for the operator. Take off **213** will send a command to the aircraft to transition from ground mode to hover stationary. Selection of cancel icon **206** cancels control of the rotary-wing aircraft **100** by control device **10**.

Upon selection of takeoff **213**, the control device **10** will ask for confirmation as shown in FIG. **12**. The human machine interface will provide the option to confirm **211** or reject **206** the last command. A confirm **211** will send the takeoff command to the aircraft for verification by the VSM **104** prior to commanding the rotary-wing aircraft to transition from ground mode to hover stationary at a predetermined altitude.

FIGS. **13**, **13**A and **13**B depict a human-machine interface on a control device **10** in an exemplary embodiment in the hover manual mode, entered upon the selection of the video icon **203** in FIGS. **9**A or **10**A. This embodiment uses the same method of control as the embodiment in FIG. **9** and FIG. **10** with the exception that there is a real time video underlay on the human-machine interface.

FIGS. **14**, **14**A and **14**B depict a human-machine interface on a control device **10** in an exemplary embodiment in the hover manual mode. The command icons **204** remain the same as in the respective modes in FIG. **9**A and FIG. **10**A, however, position control in this embodiment is inputted into the control device **10** by clicking the desired location on screen **12** via the downward looking camera video underlay **236**. Altitude and heading commands are inputted the same way as in FIG. **9** and FIG. **10**, using the up **212** and down **214** icons.

FIG. **15** depicts operational states of the rotary-wing aircraft **100** and control device **10** in exemplary embodiments. Rotary-wing aircraft **100** may be manned or un-manned when control device **10** is issuing control commands to rotary-wing aircraft **100**.

At **300**, control device **10** receives a list of available aircraft. This list may be pulled by control device **10** or pushed to control device **10** by local aircraft requesting control. At **302**, the control device **10** may query a user for an access code to ensure that only authorized users control the rotary-wing aircraft **100**. Upon establishing communications between the control device **10** and the VMS **104** to receive aircraft **300** and entering the appropriate access code **302**, the control device **10** is set to hover stationary mode **322**, ground stationary mode **408**, or enroute **304** (which will automatically transfer to hover stationary at the completion of the current flight plan leg) at **400** to reflect the actual mode of the rotary-wing aircraft **100**.

From hover stationary **322**, the user can enter various modes, including enroute **304**, hover manual **306**, or ground mode **408**. Enroute mode **304** causes the rotary-wing aircraft **100** to follow a preloaded flight plan, which is implemented by VMS **104**. Ground mode **408** causes the rotary-wing aircraft **100** to land and enter ground mode **408**. The hover manual mode **306** allows the user to control altitude, position and heading of the rotary-wing aircraft **100** using the icons described above. Hover stationary **322** also allows user to display sensor/video data at **409**.

Hover manual mode **306** also includes two command sets, unloaded **308** and loaded **310**. In the unloaded mode **308**, the control device **10** may be used to auto-load **312** or lift load **314**. Other unloaded mode operations include but are not limited to selecting a load **336**, centering over a load **338** and hooking the load **340**.

In the loaded mode, the control device **10** may be used to place a load **318**, release a load **320** and return to hover stationary **322**. Other loaded mode operations include, but are not limited to, auto release of a load **328**, release a sling **330** and dropping load at a point **332**.

Hover manual mode **306** also allows transition back to hover stationary **322** or entry of flight control commands at **316**. Hover manual **306** allows a user to display sensor/video data **409** in video underlay mode **324** and allows entry of flight heading by selecting points on the video underlay in a point and go mode **326**, as described above with reference to FIG. **14**.

Control device **10** is designed to provide a control device operator with fewer, dedicated commands that can be operated on a small, control device. Additionally, the high level of autonomy on the rotary-wing aircraft enables a more simplistic human-machine interface, not currently used today on fielded systems. The control device **10** has applications for military, civilian and commercial applications. With the widespread use of smart devices (e.g., by military personnel), embodiments offer the opportunity to utilize these smart devices to host control applications for rotary-wing aircraft in a myriad of applications.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. While the description of the present invention has been presented for purposes of illustration and description, it is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications, variations, alterations, substitutions, or equivalent arrangement not hereto described will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the invention. Additionally, while various embodiment of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

The invention claimed is:

1. A control system for portable control of a rotary-wing aircraft, the control system comprising:
- a portable, hand-held, control device executing a control application, the control device operating in a loaded mode when a load is attached to the rotary-wing aircraft and an unloaded mode when no load is attached to the rotary-wing aircraft, the control device presenting command icons in response to being in loaded mode and unloaded mode;
- a vehicle management system in the rotary-wing aircraft;
- a sensor package on the rotary-wing aircraft; and
- a communication system providing communications between the control device and the rotary-wing aircraft, vehicle management system and sensor package;
- wherein the control device communicates commands to the vehicle management system to implement loading and unloading of the rotary-wing aircraft;
- wherein the control device executes a receive aircraft mode, hover mode, en-route mode and ground mode, wherein in the receive aircraft mode, the control device presents a list of aircraft within range of the control device and available for control by the control device, wherein in the hover mode, the control device presents icons to control the rotary-wing aircraft in a hover flight, wherein in the en route mode, the control device commands the rotary-wing aircraft to follow a preloaded flight plan and wherein in the ground mode, the control device commands the rotary-wing aircraft to land.

2. The control system of claim **1** wherein:
- the communication system includes a wireless router in communication with the control device and a data link coupled to the wireless router;
- the rotary-wing aircraft including a second data link in communication with the data link and coupled to the vehicle management system.

3. The control system of claim **1** wherein:
- the communication system includes a cellular network in communication with the control device;
- the rotary-wing aircraft including a cellular network modem in communication with the cellular network and coupled to the vehicle management system.

4. The control system of claim **1** wherein:
- the communication system includes a data link coupled directly to the control device;
- the rotary-wing aircraft including a second data link in communication with the data link and coupled to the vehicle management system.

5. The control system of claim **1** wherein:
- the communication system includes a communication element within the control device;
- the rotary-wing aircraft including a wireless router in communication with the communication element and coupled to the vehicle management system.

6. The control system of claim **1** wherein:
- the hover mode includes a hover stationary mode and a hover manual mode.

7. The control system of claim **6** wherein:
- in hover manual mode, the control device presents flight control icons for controlling the rotary-wing aircraft.

8. The control system of claim **7** wherein:
- the flight control icons include altitude icons for controlling altitude of the rotary-wing aircraft.

9. The control system of claim **7** wherein:
- the flight control icons include position icons for controlling position of the rotary-wing aircraft.

10. The control system of claim **7** wherein:
- the flight control icons include heading icons for controlling a heading of the rotary-wing aircraft.

11. The control system of claim **6** wherein:
- in hover manual mode, the control device presents command icons for initiating an operation by the rotary-wing aircraft.

12. The control system of claim **11** wherein:
- in hover manual mode, the command icons include a cancel icon for terminating active command of the rotary-wing aircraft and transitioning to a stable state.

13. The control system of claim **11** wherein:
- in hover manual mode, the command icons include a hover stationary icon for instructing the rotary-wing aircraft to hover at a fixed position.

14. The control system of claim **11** wherein:
- in hover manual mode and no load detected attached to the rotary-wing aircraft, the command icons comprise a video/sensor icon for initiating display on the control device of real-time streaming footage from the rotary-wing aircraft for situational awareness, auto load, select load, center over load, hook load, and lift load.

15. The control system of claim **11** wherein:
- in hover manual mode and a load detected attached to the rotary-wing aircraft, the command icons comprise a video/sensor icon for initiating display on the control device of real-time streaming footage from the rotary-wing aircraft for situational awareness, auto release load, place/lower load, release load, release sling, and drop load at point.

16. The control system of claim **1** wherein: the ground mode includes a ground stationary mode and a ground manual mode.

17. The control system of claim **1** wherein:
- in ground mode, the command icons comprise video/sensor icons for initiating display on the control device of real-time streaming footage from the rotary-wing aircraft for situational awareness.

18. The control system of claim **1** wherein:

in ground mode, the command icons include take off vertically to a predetermined altitude.

19. A portable, hand-held, control device for portable control of a rotary-wing aircraft, the control device comprising:

a display;

a wireless communication device for communications with at least one of a vehicle management system and a sensor package on the rotary-wing aircraft; and

a processor executing a control application, the control application operating in a loaded mode when a load is attached to the rotary-wing aircraft and an unloaded mode when no load is attached to the rotary-wing aircraft, the processor presenting command icons on the display in response to being in loaded mode and unloaded mode;

wherein the processor communicates commands from the wireless communication device to the vehicle management system to implement loading and unloading of the rotary-wing aircraft;

wherein the control device executes a receive aircraft mode, hover mode, en-route mode and ground mode, wherein in the receive aircraft mode, the control device presents a list of aircraft within range of the control device and available for control by the control device, wherein in the hover mode, the control device presents icons to control the rotary-wing aircraft in a hover flight, wherein in the en route mode, the control device commands the rotary-wing aircraft to follow a preloaded flight plan and wherein in the ground mode, the control device commands the rotary-wing aircraft to land.

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